DOCUMENT RESUME

ED 348 015 IR 015 752

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TITLE Filmmaking and the Development of Cognitive Skills.
PUB DATE Feb 92
NOTE 15p.; In: Proceedings of Selected Research and Development Presentations at the Convention of the Association for Educational Communications and Technology and Sponsored by the Research and Theory Division; see IR 015 706.
PUB TYPE Information Analyses (070) -- Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Abstract Reasoning; Comparative Analysis; *Film Production; Foreign Countries; Higher Education; Hypothesis Testing; Literature Reviews; Psychological Studies; *Skill Development; *Spatial Ability; Thinking Skills; *Undergraduate Students
IDENTIFIERS University of Windsor (Canada)

ABSTRACT

This study was conducted at the University of Windsor (Ontario) to determine whether an intensive introductory course in filmmaking cultivates spatial visualization and abstract reasoning, and whether success in filmmaking is directly related to one's level of spatial visualization and abstract reasoning. In order to test the research hypotheses, a quasi-experimental, nonequivalent control group design was employed. An intensive 8-month introductory course in 16mm film production served as the treatment; the control group received no media or film instruction. Students were administered a series of two tests to measure their abstract reasoning ability and spatial visualization four times during the course. The groups were compared with respect to their performance on the tests as measured over the 8 month period. A detailed account of the amount of time spent by subjects in the treatment group on various filmmaking activities was kept and an assessment of the quality of the student films produced was also made. The results provide compelling evidence to suggest that the introductory filmmaking course had no effect upon the cultivation of spatial visualization of abstract reasoning; in fact, it was the comparison group that increased the most with respect to level of spatial visualization. There was no significant difference between the groups with respect to their increase in abstract reasoning. Detailed discussions of these results, their implications, and suggested topics for future research conclude this paper. (36 references) (BBM)

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Introduction

As someone trained as a filmmaker, I often wonder how the years spent learning and practicing my craft have changed me. In recent years, I have become increasingly aware of instances when I find myself slipping into what I think of as my "filmmaker mode". As I pour over research articles in an attempt to see inter-relationships and connections, revise a paper on my word processor, or pare down and organize data on a spreadsheet, I am reminded of the many hours I have spent in an editing room sifting through reels of film to find just the right combination of shots. I am perhaps most aware of this "filmmaker mode" when I am in a new place. I consciously begin to select a series of mental snapshots and to differentiate between the many layers of sound present around me. In essence, I break my surroundings down into discrete chunks of visual and aural data which later helps me remember what I have seen and heard in rich detail. These personal anecdotes suggest that the practice of filmmaking has changed me -- that it has in some small way altered the way I perceive and interact with the world around me.

Sol Worth (1973) was the first to note the potential cognitive effects of filmmaking and suggested that the practice of filmmaking could be harnessed as an educative experience in the classroom. Worth described the predominant use of film in the classroom -- film as a delivery system -- as a "substitute" for books and lectures. He further characterized the intent of this use of the medium as "learning through film" -- what the student is intended to learn is the content presented in the film. The second and, according to Worth, the most powerful use of film in the classroom, relates to how the medium works as a system of communication -- something Worth called "learning about media". Worth suggested that the skills developed through such an understanding, a set of skills referred to as "film literacy", would allow the learner to view the world in a new way:

> Filmmaking could become one of the important tools by which we allow and help the child as well as the adult to develop skill in building cognitive structures and in structuring reality in a creative, communicative way. Although we can teach *through film* [emphasis added], we must begin to understand how the structure of film itself and the visual modes, in general, structure our ways of organizing experience. (p. 302)

Theoretical Support

The notion that the act of filmmaking may change the filmmaker in important ways is, in part, explained by a body of theoretical work that describes ways humans are able to perceive and represent the world in a variety of symbolic forms or systems (Olson and Bruner, 1974; Salomon, 1979; Gardner, 1983). This work makes two basic claims. The first claim is that cognitive representation and processing are carried out in various symbolic modes. The second is that these cognitive operations can be influenced by the symbol systems employed by media (Clark and Salomon, 1986). For example, the act of writing a cogent essay draws upon different symbolic competencies than the act of composing a symphony or taking a photograph, because each of these mediated messages is cast in a different set of symbolic forms. (Gardner, 1983).

One of the most useful "symbol system" theories is one proposed by Salomon (1979) because Salomon makes an important link between symbol systems and media (Clark and Salomon, 1986). Salomon's theory suggests that both media and the human mind use symbols to represent, store, and manipulate information and

that some of the symbol systems used in cognition are cultivated through the manipulation of the symbol systems employed by media.

Each symbolic competence is comprised of a set of cognitive skills that must be mastered in order for an individual to be fluent in that particular symbol system. Researchers like Gardner (1983) and Olson (1974) prefer to think of these various kinds of symbolic competencies as different forms of intelligence. In fact, Gardner identifies five different kinds of intelligence or symbolic competency: linguistic intelligence, musical intelligence, logical-mathematical intelligence, spatial intelligence, and bodily-kinesthetic intelligence. What cognitive skills might the act of filmmaking cultivate? Prior empirical work (Tidhar, 1984; Sutton-Smith, 1979) and a detailed examination of the cognitive tasks involved in filmmaking suggests that among the most likely kinds of cognitive abilities to be developed from the practice of filmmaking are spatial abilities and skills of abstract reasoning.

Filmmaking: A Conceptual Analysis

Filmmaking is a difficult process to examine because it involves many diverse tasks and is often carried out by many skilled craftspersons such as directors, actors, camerapersons, and editors. This is particularly true within the professional feature film industry where it is difficult to describe any one individual as a filmmaker. The vast majority of films made, however, are not feature films and are not characterized by such a large and diverse labor force. These films are often made by individuals who are responsible for all phases of production from initial concept through shooting and editing to finished film. Under such conditions, the term "filmmaker" more accurately describes the people involved.

In its basic form, filmmaking can be seen as two fundamental processes: the collection and crafting of discrete visual and aural elements into communication -- a series of messages that conveys meaning (Eisenstein, 1949). In film parlance, the collection stage is referred to as "filming" or "cinematography". The crafting stage is called "editing". Both stages are particularly complex because of the cognitive visualization requirements of the tasks. It is important to note that such a definition suggests that filmmaking need not necessarily occur with conventional motion picture cameras and editing equipment. The sort of collecting and crafting of images and sound described here can be carried out with video equipment, with a still camera and an audio cassette recorder, or even with the latest in microcomputer technology.

During the collection stage the filmmaker must carefully visualize the way a finished shot will look. This includes not only visualizing the content of the shot: the setting, the time of day, season, the movement of objects within the frame, but also the relationship of the frame to this visual content. Should the frame emphasize certain objects and if so how? For example, should the camera shoot the scene from a high or low angle? Should the camera shoot the scene from the front or back or perhaps from the side? Each of these options must be carefully imagined.

The filmmaker's visualization task is made more complex by the fact that the camera and scene being shot may not be static. For example, the camera may move towards an actor as the actor simultaneously moves towards the camera or the camera may "crane" into the air as an actor moves away from the camera. This sort of complex visualization requires the ability to mentally picture an object or objects from any conceivable vantage point. In the simplest case, both the vantage point and the object are static. In the most complex case, both the vantage point and the object are moving independently of each other.

The crafting phase of filmmaking, often referred to as editing, entails the assembly of individual shots and corresponding sound (Pudovkin, 1958). It is during this stage of production that the raw data are reviewed and distilled into the filmmaker's original conception. It is during the assemble stage that a filmmaker's visualization ability is tested once again. The filmmaker must organize the shots in such a way as to ensure that each edit appears invisible. This is done by making sure that the finished scene creates the illusion of a continuous flow of action. This means that the many takes of a scene that were shot sequentially must be edited to appear as if they were shot at the same time. To create such a continuity of action, the filmmaker must be able to visualize the finished scene from beginning to end as it will appear in the finished movie. The visualization task called upon at this stage is similar to the one required at the collection stage. The filmmaker must have the ability to imagine the objects in the scene as they move relative to each other over time. In addition, the filmmaker must be able to visualize these changes from different vantage points.

An actual editing problem illustrates the complexity of the visualization task. An editor must edit together four different shots of a car smashing into a passenger train. Shot one shows a long shot of a car hurtling towards a level crossing as a high speed passenger train approaches in the background. Shot two is taken from the point of view of the driver of the car. We see the driver's hands thrown up in fear as the train suddenly appears through the windshield. Shot three is a close up of the driver as he shields his face. Shot four is a long shot of the car crashing into the train and exploding in a huge ball of fire. In order for these shots to flow smoothly together, the spatial relationship between the car, the train, and the actor must be the same from edit to edit. The editor must be able to visualize these constantly changing spatial relationships as he or she imagines the finished scene.

Another important cognitive skill is called upon during the editing process. In the early stages, film editing is, essentially, an exercise in visual organization. Images must be identified and then organized into a workable conceptual framework. This organizing phase, in essence, becomes an exercise in visual concept classification. Suitable categories must be formulated and then each set of images (a shot) must be classified according to the framework.

For example, shots may be classified according to the type of camera movement used, the type of coverage (long shot, close-up, medium shot), the type of action within the shot, the location of the shot or simply the overall quality of the shot. Once a framework has been created and the raw footage broken down and organized, the filmmaker begins to assemble the individual shots into scenes. Since the ability to organize visual data is apparently linked most with editing, while the ability to visualize spatial forms is called upon in both editing and cinematography, it would seem likely that skill in spatial visualization is more likely to be cultivated through an initial filmmaking experience.

A Review of Past Studies

Several studies have specifically investigated the effect of filmmaking on the cultivation of cognitive skills. Tidhar (1984) demonstrated that junior high school students who were taught filmmaking skills showed significant improvement on measures of logical inference, spatial aptitude, and conceptual focusing as compared to a non-filmmaking control group.

Eighty-seven fifth grade students were randomly assigned to four different 55 hour filmmaking courses. The first group was taught photography only, the second script writing and photography, the third photography and editing, and the forth

was taught editing only. The course lasted 10 weeks and consisted of two 3 hour sessions per week. A series of 8 tests, including the DAT (1980) space relations and abstract reasoning tests were administered to the students 3 weeks after the completion of the film course. Through factor analysis, the 8 scores were combined into measures of logical inference, spatial aptitude and conceptual focusing. All filmmaking treatments and particularly the editing group, resulted in significant increases in scores as compared to a control group which did not receive the treatment.

A three year study that investigated the New York City Young Filmmakers Program (Sutton-Smith, 1979, Sutton-Smith, Eadie, and Griffin, 1983) provided evidence that filmmaking had a significant educational impact upon children. One hundred and fifty students ages 5 to 16 years and of varying ethnic and socio-economic status participated in the study. Approximately 300 short films were produced. The major hypothesis of the study was that children who received intense training and practice in filmmaking would demonstrate significant gains in their ability to organize and manage internal visual imagery.

Impact was assessed along three dimensions: perceptual, cognitive and personal. Perceptual competencies were defined in terms of the learner's ability to notice visual details and to discern hidden aspects of reality which may not have been so obvious beforehand. The Witkin's Embedded Figures Test (1954) and the Goodenough-Harris Draw a Man Test (1961) were used as measures of perceptual competence. Cognitive organization was measured by performance on the Wechsler Intelligence Scale for Children (WISC) (1950). In particular, the sections dealing with picture arrangement/picture completion and block designs were emphasized. Personal development was equated with creativity which was measured by performance on the figural section of the Torrance creative thinking test and the individual's sense off personal autonomy which was measured by performance on a locus of control test.

Results of the study showed that significant changes in cognitive measures were directly related to the number of films made and the amount of time spent at the workshop. Those completing at least one film showed significant increases in their performance on the Block Design subtest of the WISC and a significant internal shift on the locus of control measure. In addition, a majority of the children who participated in the filmmaking workshop showed significant gains in scores on the Embedded Figures Test. Another important finding was related to the characteristics of learners who made at least one film compared with those who dropped out. Those who completed one or more films had significantly higher scores on the WISC Picture Completion subtest and the Object Assembly subtest; had a better memory for films that they had observed being made in New York; and were more often the youngest of a small family or the eldest of a large family.

Both the Tidhar (1983) and the Sutton-Smith (1979) studies suggested that the cultivation of spatial and abstract reasoning skills were among the important cognitive benefits from prolonged filmmaking practice. Both studies examined the cognitive effects of filmmaking on relatively young subjects -- between the ages of 6-16. Two important weaknesses of these studies should be noted. First, both studies relied on relatively weak treatments -- approximately 50 to 75 hours of filmmaking practice. Second, both studies failed to develop a compelling rationale for the cognitive measures used.

Spatial Skills and Abstract Reasoning

Spatial ability (also referred to in the literature as spatial intelligence) is "skill in representing, transforming, generating, and recalling symbolic, non linguistic information (Linn and Petersen,1985, p 1482). Linn and Petersen (1985) contend that spatial ability is comprised of three basic skills: spatial perception, mental rotation, and spatial visualization.

Research studies have shown that success in certain academic subject areas and vocations is, in part, a function of an individual's spatial aptitude. Spatial scores are directly related to performance in courses such as plane geometry, drawing, mathematics, and shop (McGee, 1979). Spatial aptitude has also been shown to be a good predictor of success in such occupations as architecture, computer science, art and engineering (McGee, 1979).

The present study focuses upon one of the most complex spatial abilities, spatial visualization. Spatial visualization tasks involve a number of steps and must be solved by using "an analytic combination of visual and non-visual strategies" (Thomson, 1989, p. 17). Spatial visualization subsumes spatial perception and mental rotation. Spatial perception involves the "comprehension of the arrangement of elements within a visual stimulus pattern and the ability to remain unconfused by the changing orientation in which a spatial configuration may be presented" (McGee, 1979, p. 893). Mental rotation is the ability to mentally manipulate the orientation of spatial forms.

Successful spatial visualization requires subjects to carefully analyze a problem visually and select an appropriate solution strategy. It is the multi-step, multi-strategy, analytic characteristic of the task which distinguishes spatial visualization from other spatial skills (Linn and Petersen, 1985).

Abstract reasoning is the ability to determine relationships between visually presented, non-semantic information (Anastasi, 1982, p. 290). Formalized tasks of abstract reasoning require the ability to analyze a set of apparently disparate patterns, create a meaningful context for the patterns, and then select like patterns for inclusion in the set (Cronbach, 1960).

The ability to create a meaningful context for visual information appears to be important during the editing stage of filmmaking. Editing entails the shaping and structuring of vast amounts of visual data in the form of hundreds or even thousands of individual shots. The filmmaker needs a coherent conceptual framework to aid in the organization of the many shots.

Rationale For Study

Determining whether spatial skills and skills of abstract reasoning are cultivated through filmmaking is important for four reasons.First, the study may yield support for or against the inclusion of filmmaking within high school and university curricula. There are currently more than 3000 film courses at 600 universities and colleges across North America (Bohn and Stromgren, 1987). Since the vast majority of students enrolled in film production courses never pursue a professional filmmaking career, it may be possible to identify the development of certain cognitive skills as a valuable by-product of making movies within an educational setting. In addition, the rapid proliferation of inexpensive home video equipment has meant that filmmaking is now an activity that millions engage in. How might

these individuals expect to be affected by their hobby? Several studies already suggest that filmmaking practice is beneficial by showing that it cultivates certain cognitive skills. For example, Tidhar (1983) showed that a 55 hour filmmaking course led to significant increases on measures of logical inference, spatial ability, and conceptual focusing among junior high school students.

Second, the skills gleaned from making films may be applied to apparently more complex or more abstract activities -- such as essay writing (Constanzo, 1985). In other words, filmmaking can be employed as an instructional intervention. A knowledge of the skills filmmaking cultivates will help educators to design such interventions. Filmmaking has been used as a means of facilitating high school students' appreciation and understanding of literary structure (Cox, 1985). Filmmaking has also proved to be a useful means of helping students engage more enthusiastically in the revision of written work (Primeau, 1974). Since revision (editing) is such a self-evident part of filmmaking, students exposed to it seem more willing to rework other forms of self-expression such as term papers and essays. Also, the production of a short film on the American Civil War, for example, may be a more effective means of offering certain students the opportunity to gather and synthesize knowledge about the topic than writing a conventional term paper would (Cox, 1985).

Given that filmmaking can serve as an instructional intervention, it is conceivable that aspects of filmmaking practice could be incorporated as part of a computer-based lesson or data-base management program. For example, the film-editing process could be simulated as part of a lesson designed to teach learners about dramatic structure in short stories. Learners would be able to manipulate (reorder, shorten, lengthen) sections of a short story and then view the result -- just as a film editor would cut a short film. Computer-based data base management programs might be successfully manipulated along a film-editing model. Information on a particular topic could be stored as a specific shot and then reworked into scenes that incorporate a number of specific entries. Other educational applications of filmmaking can be identified and developed.

Third, the study may lead to a better understanding of the filmmaking process itself which in turn may suggest new ways of teaching filmmaking. If certain cognitive skills are fundamental to the making of good films then perhaps these skills need to be stressed during any filmmaking course.

Fourth, the perspectives and methods used to understand and harness the practice of filmmaking as an educational activity may be successfully employed with other types of mediated practice such as computer programming and data-base creation and management. In other words, viewing the activity of filmmaking as an educative experience, redefines the way the field of educational technology views the role of media in education. It suggests that media are not benign devices through which instructional content passes but devices that liberate learners -- that allow them to experience and shape the world around them in new ways, perform unique tasks, and possibly acquire unique abilities previously unattainable or, at least, acquire generic skills more easily or in other ways. This perspective has important implications for an educational system that largely ignores the possibility that beneficial side-effects accrue from learning activities (Perkins and Salomon, 1987).

Hypotheses

In order to determine whether an intensive introductory course in filmmaking cultivates spatial visualization and abstract reasoning, and whether success in filmmaking is directly related to one's level of spatial visualization and abstract reasoning the following research hypotheses were formulated:

1) Learners who receive intensive training and practice in filmmaking will show greater improvement, over time, in their ability to perform tasks of spatial visualization and abstract reasoning compared with learners who do not receive training in filmmaking.

2) A subject's spatial visualization and abstract reasoning ability is directly related to the quality of film produced.

3) A subject's increase in spatial visualization ability is directly related to time spent editing and time spent engaged in cinematography.

4) A subject's increase in abstract reasoning ability is directly related to time spent editing.

Method

In order to test the research hypotheses, a quasi-experimental, nonequivalent control group design was employed. Subjects were conveniently selected from among first and second year university students (the equivalent of sophomores and juniors at an American university) at the University of Windsor in Windsor, Ontario. An intensive introductory 8 month course in 16mm film production served as the treatment while a comparison group received no film or media instruction. Subjects were administered a series of two tests four times during the 8 month period. The tests were given approximately every 8 weeks. The tests measured subjects' spatial visualization and abstract reasoning ability. The two measures were taken from the Differential Aptitude Tests (1980). The groups were compared with respect to their performance on the tests as measured over the 8 month period. A detailed account of the amount of time spent by subjects in the treatment group on various filmmaking activities was kept and an assessment of the quality of the student films produced was also made.

Results

There appeared to be compelling evidence to suggest that the introductory filmmaking course had no effect upon the cultivation of spatial visualization or abstract reasoning. First, it was the comparison group and not the treatment group that increased the most with respect to level of spatial visualization. Second, there was no significant difference between the groups with respect to their increase in abstract reasoning.

These apparently unequivocal results, however, are muddied by a number of factors. To begin with, if the treatment were ineffectual, one would expect no difference between the groups with respect to the degree of increase in spatial visualization. A learning effect is one plausible explanation for the rapid increase in the comparison groups' level of spatial visualization. Subjects were increasingly able to remember the answers to those question they found easy and spend more time working on those items of higher difficulty Given the nature of the course material and the other courses comparison group subjects were taking, it is unlikely that this increase can be attributed to anything other than repeated exposure to the

same instrument. In addition, interview data suggested that subjects felt they were increasingly better able to "psych out" the test.

A partial ceiling effect is a plausible explanation for the comparison groups *more* rapid improvement relative the treatment group. The treatment group's average score on the first trial was 43.1 out of a possible 60. The comparison group scored an average of 39. By the second trial the treatment group scored 47.8 and the comparison group scored 45.1. By the third trial, the treatment group scored 48.2 and the comparison group 46.7.

It could be argued that by the time of the second trial, a significant portion of the treatment group scored sufficiently well that there was little room for improvement on the subsequent two trials. The comparison group, on the other hand, scored below the treatment group on the first two trials and thus had more room for improvement. As the results show, the comparison group actually caught up to the treatment group by the fourth trial scoring 49.1 compared with 49.6 for the treatment group.

Unlike level of spatial visualization, there were no significant differences between the groups with respect to increases in level of abstract reasoning. As with spatial visualization, however, the increases in abstract reasoning may be attributed to a learning effect from the instrument. Both groups increased by nearly identical amounts: 36.9 to 40.0 for the treatment group and 37.2 to 40.7 for the comparison group. There is no evidence of a ceiling effect with the abstract reasoning measure.

These results contradict those of the Tidhar and Sutton-Smith studies. It could be that age is a salient variable in the development of both spatial visualization and abstract reasoning. Both the Tidhar and Sutton-Smith studies examined the cognitive impact of filmmaking on subjects aged 6 to 16. In both cases subjects who received training in filmmaking displayed significant improvement in their performance on spatial and abstract reasoning tests. The current study, however, deals with college-aged subjects. Perhaps the younger subjects of the Tidhar and Sutton-Smith studies were at an age when their cognitive skills were developing rapidly and may have been susceptible to interventions that might have quickened this cognitive development.

There is evidence to suggest that skill of mental rotation (an important element in spatial visualization) begins to develop rapidly in children around the age of 8. Prior to this age, children make frequent mistakes in their attempts to predict the appearance of rotated objects (Inhelder & Piaget, 1958). By the time children reach the age of 10, they are able to mentally rotate objects nearly as well as adults (Kail, Pelligrino, and Carter, 1980) although the rate of mental rotation approximately doubles between this age and adulthood (Corbollis, 1983).

If the above is true, possibly the college-aged subjects of the present study, as a group, already possessed well developed and stable spatial visualizations and abstract reasoning skills – skills not likely to be affected by any instructional intervention. The increases that the filmmaking and non-filmmaking subjects did experience were possibly due to their increasing familiarity with the test and not effects of filmmaking.

It is possible, however, that the treatment group was able to perform the spatial visualization and abstract reasoning tasks at an increasingly faster rate compared to the comparison group. This follows from Corbollis' (1983) assertion that change in spatial visualization skill for teenagers and adults is reflected solely in terms of speed of execution. Unfortunately, time on task data was not collected during the testing sessions.

The other focus of the study was to determine the extent to which the cognitive skills of spatial visualization and abstract reasoning were an integral part of the filmmaking process. Certainly the results appear unequivocal. Neither spatial visualization or abstract reasoning was positively associated with course grade or final film grade. In addition, time spent editing and/or filming was not related to increases in spatial visualization or abstract reasoning.

It may be that with filmmakers of this age other factors such as effort (time spent making films was directly related to course grade) and conceptual preparation (the preparation of a clear and creative shooting script) are as or more important in determining whether a high quality student film is produced but this can not be established given the data at hand.

Another plausible explanation for the low correlation between level of spatial visualization and abstract reasoning and a subject's final grade should be noted. A close examination of the final grade reports showed that non filmmaking activities, such as essays, scripts, and exams accounted for more of the final grade than filmmaking assignments. In other words, the final course grade was not a good measure of filmmaking ability.

Implications and Suggestions For Future Research

The results of this study should not deter future research into the effects of active expression through visual media. Nor should these results call into question the inclusion of filmmaking in high school and university curricula; however, further investigations of filmmaking and its cultivation of spatial and abstract reasoning skills in adults may not to be fruitful. However, additional work is necessary to better understand the relationship between these cognitive skills and filmmaking. Future research should also strive to identify more meaningful ways in which the activity of filmmaking changes the filmmaker. With this information in hand, filmmaking courses can be more wisely incorporated into school curricula.

Clearly, there is need for conceptual research to help articulate meaningful dimensions of impact. Such research would form the basis for further empirical work. Within the cognitive domain, what other skills might likely be enhanced by the manipulation of visual and aural information. Perhaps filmmaking effects the way visual data are stored and retrieved.

These questions have greater importance now that small format video technology is so readily accessible. Millions of people experience significant parts of their lives – their vacations, their child's first birthday, their daughter's wedding – by peering through the viewfinder of a video camera. They then "relive" these experiences by repeated showings of the images and sounds they have collected. How are one's perceptions of these experiences altered by the technology used to collect and view them?

It is also important to explore the effect of filmmaking in ways other than cognitive skill development or in terms of how it shapes and alters our perceptions. For example, how might filmmaking develop team building skills or facilitation skills. How might filmmaking encourage dialogue within a community? During the late 1960's and early 1970's, the National Film Board of Canada embarked on an ambitious plan to teach filmmaking to Canadian native groups. The natives used their new skills to produce films about their goals and aspirations and the many problems they faced. The project, in essence, acted as a needs assessment exercise

for the natives. It facilitated discussion among the native community and helped the community to identify problems and possible solutions.

Another related and important question is the role media production should play in a media literacy curriculum. The province of Ontario, for example, has recently completed a major high school curriculum initiative in the area of media literacy (Ontario Ministry of Education, 1989). The report suggests that "hands-on" media experience may facilitate the development of students' overall understanding of how the media affect their lives. However, more work needs to be done to confirm this and determine the kinds of media production experiences best suited to this kind of curriculum objective.

In summary, despite the non-significant findings of this study it is important that we realize the value of media not solely in terms of delivering instructional content. We need to see media as instruments that allow learners to engage in unique and educative activities and that allow learners to experience the world around them in new and exciting ways.

References

Anastasi, A. (1982). *Psychological Testing*. New York: Macmillan.

Bohn, W. T., & Stromgren, R. L. (1987). *Light and Shadows: A History of Motion Pictures*. Mountain View, CA: Mayfield.

Clark, R. E., & Salomon, G. (1986). Media in teaching. In M. C. Wittrock (Ed.) *Handbook of research on teaching: Third edition: A project of the American Educational Research Association* (pp. 464-478). New York: Macmillan.

Constanzo, W. V. (1985). Fiction into films: learning literature with a movie camera. *Teaching English in the Two-year College, 12*(1), 52-56.

Corballis, M. C. (1982). Mental rotation: Anatomy of a paradigm. In M. Potegal (Ed.). *Spatial Abilities: Development and Psychological Foundations*. New York: Academic Press.

Cox, C. (1985). Filmmaking as a composing process. *Language Arts, 62*(1), 60-69.

Cronbach, L. J. (1960). *Essentials of Psychological Testing*. New York: Harper and Row

Differential Aptitude Test (1980). The Psychological Corporation.

Eisenstein, S. (1949). *Film Form: Essays in Film Theory*. New York: Meridian Books.

Emerick, L. (1986). Lights! Camera! Learn! *Gifted Child Today* , *9*(5), 29-31.

Gardner, H. (1983). *Frames of Mind*. New York: Basic Books.

Goodenough, D. R. & Karp, S. (1961). A field dependence and intellectual functioning. *Journal of Abnormal and Social Psychology, 63*, 241-279.

Inhelder & Piaget, (1958). *The growth of logical thinking from childhood to adolescence*. New York: Basic Books.

Kail, R., Pellegrino, J., & Carter, P. (1980). Developmental changes in mental rotation. *Journal of Experimental Child Psychology, 29*, 102-116.

Linn, M. C. (1985). The cognitive consequences of programming instruction in classrooms. *Educational Researcher, 14* (5), 14-29.

Linn, M. C. & Petersen A. C., (1985). Emergence and characterization of sex differences in spatial ability: A meta-analysis. *Child Development*, 56, 1479-1498.

McGee, M. G. (1979). *Human Spatial Abilities: Sources of Sex Differences*. New York: Praeger.

Olson, D. R., (1974). Media models and symbolic systems: The forms of expression and communication. In D.R. Olson (Ed.), *Media and Symbols: The Forms of Expression Communication , and Education* (73rd Yearbook of the National Society of the Study of Education). Chicago: University of Chicago Press.

Olson, D. R., & Bruner, J., (1974). *Learning through experience and learning through media*. In D. R. Olson (Ed.), op cit.

Ontario Ministry of Education. (1989). *Media Literacy* (Ministry Publication No. 88-035). Toronto, Ontario: Queen's Printer.

Perkins, D. N. & Salomon, G. (1987). Transfer of cognitive skills from programming: When and how? *Journal of Educational Computing Research*, 3(2), 149-169.

Primeau, R. (1974). Film editing and the revision process: Student as self-editor. *College Composition and Communication* , *25*, 405-10.

Pudovkin, V. I. (1958). *Film Technique and Film Acting*. Grove Press: New York.

Salomon, G. (1972). Can we affect cognitive skill through visual media? *A.V. Communication Review*, *20*, 401-22.

Salomon, G. (1974). Internalization of filmic schematic operations in interaction with learner's aptitudes. *Journal of Educational Psychology*, *66*, 499-511.

Salomon, G. (1979). *Interaction of Media, Cognition and Learning*. Jossey Bass, San Francisco, CA.

Salomon, G. (1984). Television literacy and television vs. literacy. *Journal of Visual and Verbal Languaging*, Fall, 7-16.

Salomon, G., & Perkins, D. N. (1987). Transfer of cognitive skills form programming: When and how? *Journal of Educational Computing Research*, *3*(2), 149-169.

Salomon, G., & Cohen A. A. (1977). Television formats mastery of mental skills, and technology in education. *Journal of Educational Psychology*, *69*(5), 612-619.

Seashore, H. G., Wesman, A. G., & Doppelt, J. E. (1950). The standardization of the Weschler Intelligence Scale For Children. *Journal of Consulting Psychology, 14*, 94-110.

Sutton-Smith, B. (1979). A developmental psychology of childrens' filmmaking: Report to Ford Foundation. (ERIC Document Reproduction Service No. ED 148 330)

Sutton-Smith, B., Eadie, F., & Griffin, M. (1983). Filmmaking by young filmmakers. *Studies in Visual Communication*, *9*, 65-75.

Thomson, V. L. R. (1989). *Spatial ability and computers: Elementary children"s use of spatially defined microcomputer software*. Unpublished doctoral dissertation, University of Toronto, Toronto.

Tidhar, C. E. (1984). Children communicating in cinematic codes: Effects on cognitive skills. *Journal of Educational Psychology, 76*, 957-665.

Witkin, H. A. et al. (1954). *Personality Through Perception: An Experimental Study*. New York: Harper & Row.

Worth, S. (1974). The uses of film in education. In D. R. Olson (Ed.), In D.R. Olson (Ed.), *Media and Symbols: The Forms of Expression, Communication, and Education* (73rd Yearbook of the National Society of the Study of Education). Chicago: University of Chicago Press.